DOCUMENT RESUME

ED 327 694 CE 056 747

TITLE Computer Speech Devices for Adult Literacy Skills. Final Report.
INSTITUTION Saint Paul Technology for Literacy Center, MN.
SPONS AGENCY Office of Vocational and Adult Education (ED), Washington, DC.
PUB DATE 20 Mar 90
CONTRACT V191A80004
NOTE 52p.
PUB TYPE Reports - Descriptive (141) -- Tests/Evaluation Instruments (160)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Adult Basic Education; *Adult Literacy; *Artificial Speech; Audiovisual Instruction; *Computer Assisted Instruction; *Courseware; Decoding (Reading); Material Development; Pronunciation; Reading Instruction; Syllables; *Word Recognition; Word Study Skills
IDENTIFIERS Word Attack Skills

ABSTRACT

A project titled "Word of Mouth" was conducted to develop and evaluate model computer courseware to teach word attack skills to adult basic education students. The project was based on the use of multiple strategies to figure out unknown words, the importance of breaking down multisyllabic words, and the necessity of the use of audio in word attack instruction. Three prototype modules with audio input and output capability were developed, featuring use of context, word parts, and spelling patterns or syllabication skills. A Macintosh computer, a MacRecorder sound system, and Telex headphones with microphone were selected. Analysis of pretests and posttests from 50 students at 2 adult literacy sites, as well as comments from participants in the development of courseware, showed that students were enthusiastic about the use of computerized speech in instruction and made significant gains in word attack skills. (Appendices provide participant comments, learners' and administrators' copies of pretests and posttests, and two articles about the program.) (KC)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED327694

FINAL REPORT

Computer Speech Devices for Adult Literacy Skills
Grant Award #V191A80004
St. Paul Technology for Literacy Center
St. Paul, Minnesota

Submitted by
Claudia Bredemus, Instructional Designer
March 20, 1990

Terilyn C. Turner, Ph.D., Project Director
Claudia T. Bredemus, Instructional Designer
Scott Sayre, Instructional Developer
Katherine Wellington, Ph.D., Reading Specialist
Stacey H. Stockdill, Ph.D., Research Consultant

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

CE 056747

OVERVIEW

The Computer Speech Devices for Adult Literacy Skills project was a response to adults who wanted computer-assisted instruction in word attack skills. The goal of the project, named **Word of Mouth**, was to develop and evaluate model courseware to teach word attack skills. This goal has been accomplished, as well as all the objectives originally outlined in the proposal:

1. To design at least three prototype instructional modules to teach word attack skills using sound.
   Three modules have been completed. Each module has audio input and output features.

2. To identify and install a hardware configuration that provides high quality sound and feedback in the instructional modules.
   The Macintosh computer, a MacRecorder Sound System, and Telex headphones with a microphone were selected and used to deliver the **Word of Mouth** courseware.

3. To provide computer-based instruction in word attack skills to at least 40 ABE students using the audio-enhanced instructional modules.
   Fifty students from two adult literacy sites participated in the study that was part of this project. In addition, several more participated in the development of the courseware by providing input along the way.

4. To evaluate the effectiveness of the instruction and the effects of a speech component in teaching word attack skills.
   In October and November of 1989 we conducted a quasi-experimental study of the courseware.

5. To disseminate the results of the study and the design of the instruction.
   The results of this project have been and will continue to be disseminated to the adult literacy community via publications and the Adult Literacy and Technology Conference.

Theoretical assumptions

The theoretical assumptions that formed the basis of the project were:

1. Good readers use multiple strategies to figure out unknown words in text.
2. The ability of adults to break down multi-syllabic words is important to accessing meaning.
3. Quality audio (human or non-human) is a necessary element of instruction in word attack.
4. Adult learners should be introduced to several word attack strategies and given choices in their application.
5. The privacy, flexibility, and attractiveness of computers suggest that they are an appropriate tool for teaching word attack skills.

Proceeding from these assumptions, the project team identified these three primary word attack strategies: using the context (including the use of semantic and syntactic cues), word parts, and spelling patterns or syllabication skills. We viewed these three strategies as avenues to identifying unknown words and accessing meaning. Reading is an interactive process of using text features and prior knowledge to get meaning from text. Our goal was to demonstrate to learners that several strategies could be applied simultaneously to new words in order to identify them.

The use of context was included not only because it has the strongest support in the literature, but also because many adult disabled readers think reading is a decoding process. We wanted to legitimize the use of context to leaners who felt it was a second-rate way of figuring out unknown words. The use of context was a feature that was repeated throughout all three modules as a reminder to learners that it is always key to unlocking words.

We included a module on word parts, consistent with Dolores Durkin's model of teaching word attack skills. The study of word parts, which include morphemes (roots and affixes), makes an important link between phonemes (isolated sounds) and whole word meanings. As we gathered word lists from different sources, it became obvious to us that a lot of functional words (unemployment, qualification, immunization) were strings of similar morphemes and that the identification and teaching of key word parts would contribute significantly to learners' word attack skills.

Because a number of learners in adult education programs suffer from learning disabilities, we included a module on syllabication skills, a component of most remedial programs for the learning disabled. This decision was made in consultation with Betty Sims, a learning disabilities specialist in the St. Paul Adult Literacy and Special Needs program. Of the three modules we developed, we expected this module to have the least immediate impact on learners' word attack skills because it was a small piece of a very comprehensive sequence of skills. However, we wanted to explore what a model with audio might look like on the computer.

Hardware and software decisions

Initially, Scott Sayre, instructional developer for the project, investigated the use of a voice recognition device for the audio component of the courseware. His findings were:

> One of the most restrictive characteristics of current voice recognition systems is their dependence upon the consistency of their user's voice. Speaker dependent systems work with only the specific users that have trained them. These types of systems are generally more useful since many of them can be trained to recognize a vocabulary of 2000 or more words. However, educational applications of speaker dependent systems are quite limited since they will only recognize their trainer's voice.
>
> Speaker independent systems are designed to be used by a variety of different users without extensive training. Although this "user-openness" has many advantages, it is very restricted in the number of words it can recognize. Most of these systems will work with only about a dozen common words such as numbers or menu commands. And even some of these systems require the user to train the computer with one or two words.

Because of these technical obstacles, we chose instead a Macintosh computer with the MacRecorder sound system. We then designed an audio playback feature in which learners could say a word, hear their own pronunciation played back, and compare it to a pre-recorded pronunciation. Student use of such a self-assessing process became an additional object of our study. To use the audio feature, learners wore Telex headphones with attached microphones, much like those worn by sportscasters. Most learners found the audio template fun and instructive (see Appendix A). A few learners did not like wearing headphones.

Finally, we selected the Hypercard software program to author the modules. It is an excellent tool for designing multi-media presentations, and it works well with the MacRecorder.

Instructional Design

In addition to teaching particular skills in each module, we hoped to demonstrate to learners the importance of using more than one strategy in attacking new words. Thus, we designed an animated character that modeled different reading strategies and thought processes. We also supported learners in strategy-building by incorporating skills used in module 1 with module 2. Module 3 built on the first two modules and gave learners options to exercise all three strategies in a practice sequence.

In retrospect, we realized that a toolbox would have been a good metaphor for the courseware. Learners were taught how to use new tools for attacking words and then encouraged to choose the tool they wanted with the presentation of new words. By the time we realized that this metaphor could have been extended graphically, we had already sunk too much time into the present design of the program. However, if we have a future opportunity to revise the design, we would probably explore the toolbox metaphor.

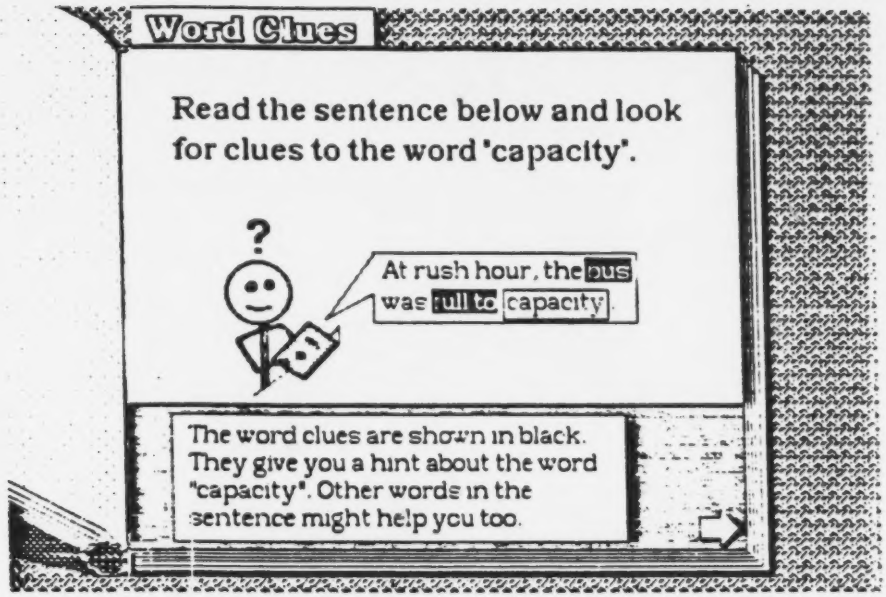
The design elements for each module are best understood by seeing and using the software, but the description below summarizes key elements:

Using the context

1. A "word clues" icon gives learners the option of using context for new words. Upon clicking the icon, a sentence containing the key word appears (figure 1). If learners cannot figure out the word from context, an additional option is available in which three similar sounding words (e.g., capacity, capital, captivity) are pronounced, and the learner chooses the semantically correct word for the sentence. This template is meant to model a strategy for figuring out words: i.e., look at the words in the sentence and use phonemic clues to generate word possibilities.

2. In the tutorial phase of the module, words that are clues to unlocking the unknown word are highlighted. Again, this demonstrates to the learner that key words in context are helpful for word recognition.

Figure 1


Word Clues
Read the sentence below and look for clues to the word 'capacity'.
At rush hour, the bus was full to capacity.
The word clues are shown in black. They give you a hint about the word "capacity". Other words in the sentence might help you too.

3. An online dictionary supplies an option of looking up the definition of a word. This dictionary is available for all three modules.

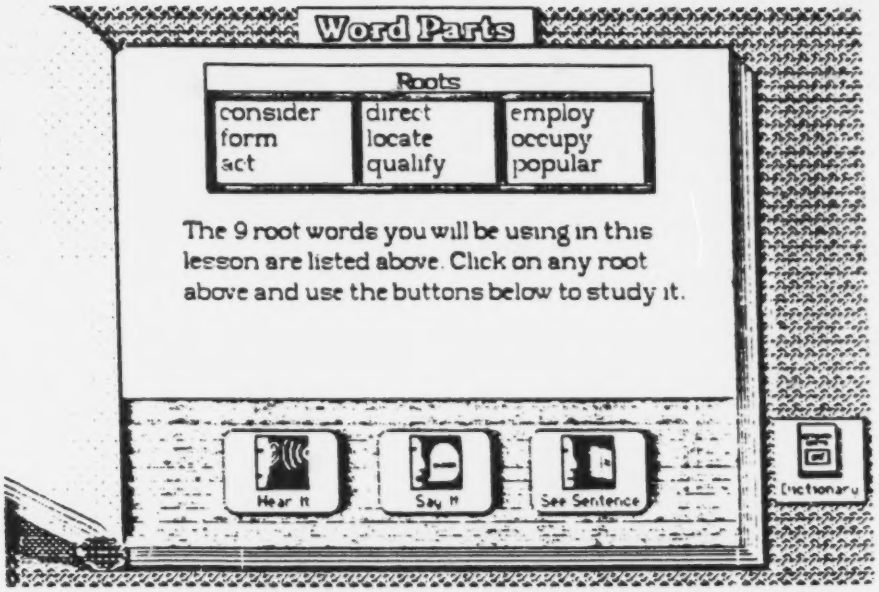
4. A "say it" icon provides the voice playback option. When a learner clicks on this option, he/she is cued to say the word into the microphone. The computer records the learner's voice, plays back the voice, and then plays a pre-recorded pronunciation of the word. Learners are then given an option to practice saying the word again (as often as desired) or go on to a new word.

Word Parts

More than the other two modules, this module has several templates and design elements for instruction in word attack:

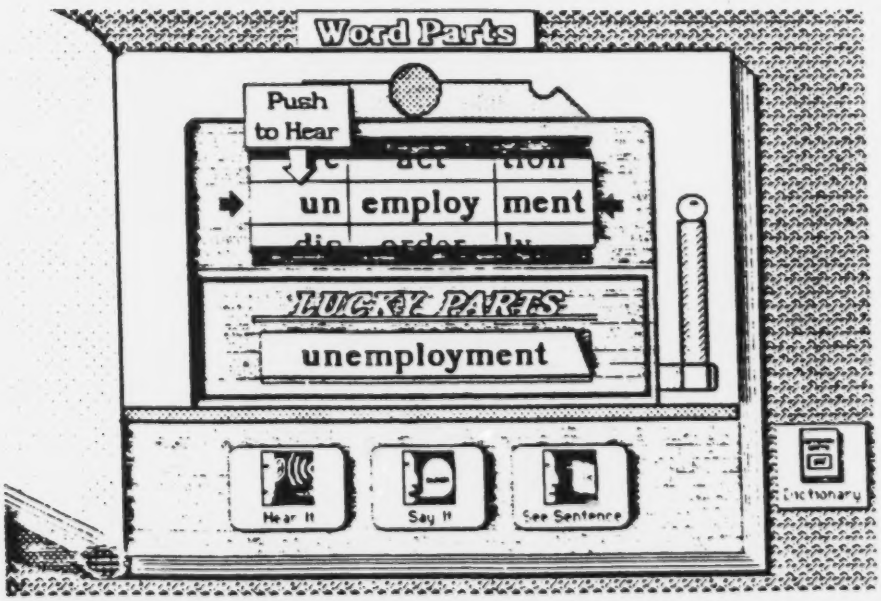
1. After a tutorial on the meaning of roots, prefixes, and suffixes, learners are presented with selected word parts to learn. They have several options available, including saying the word parts, hearing them, and seeing their meanings and use as part of words and sentences (see figure 2).

Figure 2



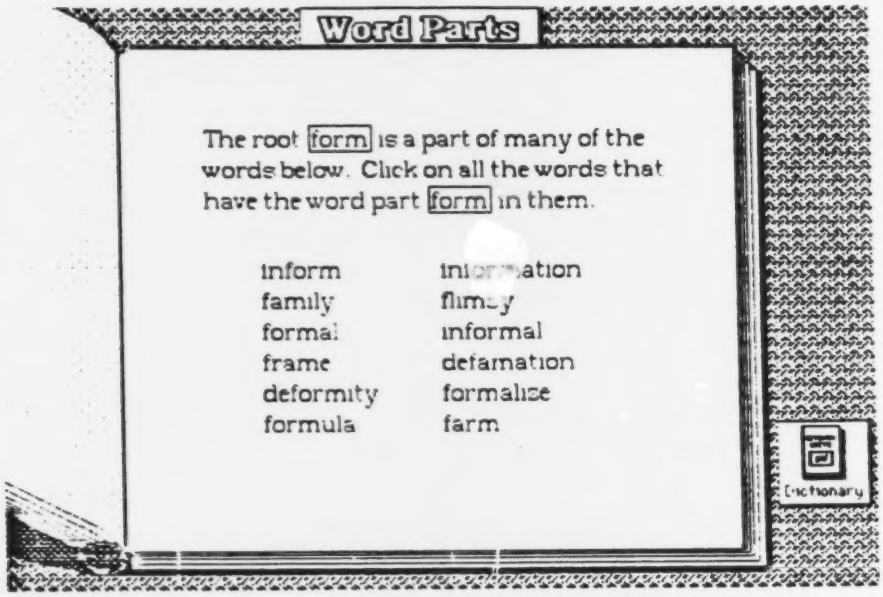
2. A game, "Lucky Parts", gives learners the chance to see word parts put together in new ways and to work with the words generated. Students who used the software liked this part of the program. (figure 3).

Figure 3



3. Another template provides learners with practice identifying particular roots in multisyllabic words (figure 4). As each word is correctly identified, it is pronounced to the learner. The dictionary may be used to access meaning.

Figure 4



Spelling Patterns

To teach even one syllabication skill (and there are many), we had to include prerequisite instruction on identifying vowels and consonants. This module assumed some rudimentary knowledge of phonics. Our assumption proved correct; learners had no difficulty applying prior knowledge of phonics to the syllabication skill taught in the lesson. The instruction for this module included design elements from the first two lessons, as well as a four step process of syllabicating words with closed syllables:

1. Find the vowels.
2. Decide how many syllables there are.
3. Divide the word into syllables.
4. Say the word.

Because of the guided practice and the regularity of the words used, most learners had no difficulty with this module. We think this model could be developed into a complete sequence of instruction particularly useful to learning disabled adults.

The Research Study

A quasi-experimental design was used to determine if the Word of Mouth program was successful in teaching word attack skills. A sample of subjects was identified at the Technology for Literacy Center (TLC) site and the Farnsworth Adult Basic Education program site. Adults in both programs are part of the St. Paul Adult Literacy and Special Needs program. In addition, a control group was selected at TLC. A pretest-posttest control group design was used where the groups were tested before the treatment to determine prior knowledge, the experimental group at TLC and at Farnsworth received the treatment, and all groups were posttested to determine changes.

Characteristics of the Subjects

The TABE vocabulary test was used to select subjects reading approximately between a third and sixth grade level. Fifty-two percent of the subjects were minorities, including Black, Native American, Asian, and Hispanic. Fifty-two percent were female. For the nonequivalent pretest-posttest control group design to be robust, it was important that the subjects did not differ with regard to their basic characteristics. We collected and compared information regarding: 1) subjects' previous use of the computer, 2) subjects' comfort level with the computer, 3) gender, 4) ethnic backgrounds, 5) level of reading skill at the beginning of the study, 6) the number of grades completed in elementary and secondary education, 7) age of subjects, and 8) and the number of months subjects had been students in the TLC or Farnsworth educational program.

The analysis of the subjects suggested that they did not differ significantly with regard to all variables studied (see Table 1). This gave the researchers some assurance that if differences were found in subsequent analyses, these differences would not be due to differences between subject groups.

TABLE 1

Computer Familiarity/Comfort

1. Have you used a computer before?

	Yes	No	No Response
TLC Experimental	19	0	0
TLC Control	16	0	1
Farnsworth Experimental	12	1	0

$X = 4.81$ Not significant at $= .05$ or $= .01$

2. How comfortable do you feel when using a computer?

	Very Comfortable			Very Uncomfortable		No Response
	1	2	3	4	5	
TLC Experimental	7	8	2	2	0	0
TLC Control	3	10	2	0	1	1
Farnsworth Experimental	2	4	5	1	0	1

$X = 12.15$ Not significant at $\alpha = .05$ or $\alpha = .01$

Demographics

1. Gender: Male/Female

	MALE	FEMALE
TLC Experimental	9	10
TLC Control	9	8
Farnsworth Experimental	5	8

$X = .62$ Not significant at $\alpha = .05$ or $\alpha = .01$

2. Ethnic Background:

	White	Minority
TLC Experimental	10	9
TLC Control	9	8
Farnsworth Experimental	4	9

$X = 1.86$ Not significant at $\alpha = .05$ or $\alpha = .01$

3. Educational Level: (As measured on TABE Standardized test)

	Average Score on TABE
TLC Experimental	4.4
TLC Control	4.2
Farnsworth Experimental	4.1

$F = .28$ Not significant at $\alpha = .05$ or $\alpha = .01$

4. Educational History: (Number of grades completed in Elementary and Secondary School)

	Average Number of Grades Completed
TLC Experimental	10.3
TLC Control	9.8
Farnsworth Experimental	9

$F = 1.12$ Not Significant at $\alpha = .05$ or $\alpha = .01$

5. Age:

	Average Age
TLC Experimental	36
TLC Control	34.6
Farnsworth Experimental	31.5

$F = 1.17$ Not Significant at $\alpha = .05$ or $\alpha = .01$

6. Number of Months in Educational Program

	Average Number of Months in Program
TLC Experimental	11
TLC Control	8.2
Farnsworth Experimental	2.8

$F = 3.07$ Not Significant at $\alpha = .05$ or $\alpha = .01$

Methods and Materials

Subjects participated in the study in two sessions. During the first session, they took a competency-based pretest designed for this study to measure prior knowledge (Appendix B). The test included 24 words from the courseware and 24 words selected to measure transfer of the skills taught in the modules. The pretest also included questions to assess comfort levels with computers (Appendix C).

To minimize testing effects, a one-week waiting period followed pretesting. Then learners in the control group took the posttest (Appendices D & E), and learners in the experimental groups used the courseware, followed by posttesting.

The post-test included questions about the strategies used to figure out test words (Appendix D, page 4). Because the testing required subjective judgments on the part of the administrator, we established criteria for determining the correctness of word pronunciation (Appendix F).

Tests of Research Hypotheses

Parametric *a priori* contrasts were used to compare the experimental and control subjects' prior knowledge with the words to be taught in the **Word of Mouth** program. This analysis was to reassure the researchers that the experimental and control groups did not differ on the dependent variable to be studied prior to treatment or no treatment. The following null and alternative hypotheses were tested using an F statistic:

HO: There is no difference between the knowledge of words included in the **Word of Mouth** program and test.

HA: The subjects differ in their knowledge of the words included in the **Word of Mouth** program and test.

The results are displayed in Table 2. The *a priori* tests failed to reject the null hypothesis, thereby indicating that the experimental and control subjects had similar knowledge prior to receiving instruction through the Word of Mouth program.

TABLE 2

HO: There is no difference between the knowledge of words included in the Word of Mouth program and test.

HA: The subjects differ in their knowledge of the words included in the Word of Mouth program and test.

A Priori Contrasts

	TLCEX Pre	TLCEX Post	TLC C Pre	TLC C Post	FARN Pre	FARN Post
	+1/2	0	-1	0	+1/2	0
Averag	23.05	36.21	19.94	33.82	24	36.54

F = 1.12 Not Significant α = .05 α = .01

Parametric *a priori* contrasts were used to compare the TLC experimental subjects' pre and post test scores. This analysis was to help the researchers determine if the **Word of Mouth** treatment improved the subjects' word attack skills. The following null and alternative hypotheses were tested using an F statistic:

HO: There is no difference between the pre and post test scores for the subjects at the TLC site who received the **Word of Mouth** treatment.

HA: There is a significant difference between the pre and post test scores for the subjects at TLC who received the **Word of Mouth** treatment.

The results are displayed in Table 3. The *a priori* tests led the researchers to reject the null hypothesis, thereby indicating that there was a difference between the pre and post tests for the subjects at TLC who received the **Word of Mouth** treatment.

TABLE 3

HO: There is no difference between the pre and post test scores for the subjects at the TLC site who received the Word of Mouth Treatment.

HA: There is a significant difference between the pre and post test scores for the subjects at TLC who received the Word of Mouth Treatment.

A Priori Contrasts

	TLCEX Pre	TLCEX Post	TLC C Pre	TLC C Post	FARN Pre	FARN Post
	-1	1	0	0	0	0
Average	23.05	36.21	19.94	33.82	24	36.54

F = 3.8 Significant α = .05 α = .01

Parametric *a priori* contrasts were used to compare the Farnsworth experimental subjects' pre and post test scores. This analysis was to help the researchers determine if the **Word of Mouth** Treatment improved the subjects' word attack skills. The following null and alternative hypotheses were tested using an F statistic.

HO: There is no difference between the pre and post test scores for the subjects at the Farnsworth site who received the Word of Mouth treatment.

HA: There is a significant difference between the pre and post test scores for the subjects at at the Farnsworth site who received the Word of Mouth treatment.

The results are displayed in Table 4. The *a priori* tests were significant at the .05 level and led the researchers to reject the null hypothesis (although with less confidence than for the other contrasts), thereby indicating that there was a difference between the pre and post tests for the subjects at Farnsworth who received the **Word of Mouth** treatment.

TABLE 4

HO: There is no difference between the pre and post test scores for the subjects at the Farnsworth site who received the Word of Mouth Treatment.

HA: There is a significant difference between the pre and post test scores for the subjects at the Farnsworth site who received the Word of Mouth Treatment.

A Priori Contrasts

	TLCEX Pre	TLCEX Post	TLC C Pre	TLC C Post	FARN Pre	FARN Post
	0	0	0	0	-1	1
Average	23.05	36.21	19.94	33.82	24	36.54

F = 3.01 Significant α = .05

Parametric *a priori* contrasts were used to compare the pre and post test scores for the control group. This analysis was to help the researchers determine if observed differences in the experimental subjects' scores

could be partially attributed to testing effects. The following null and alternative hypotheses were tested using an F statistic:

HO: There is no difference between the pre and post test scores for the control subjects.

HA: There is a significant difference between the pre and post test scores for the control subjects.

The results are displayed in Table 5. The *a priori* tests were significant and led the researchers to reject the null hypothesis. These results were disappointing because they suggested that part of the observed differences for the experimental group may be explained by testing effects.

TABLE 5

HO: There is no difference between the pre and post test scores for the control subjects.

HA: There is a significant difference between the pre and post test scores for the control subjects.

A Priori Contrasts

	TLCEX Pre	TLCEX Post	TLC C Pre	TLC C Post	FARN Pre	FARN Post
	0	0	-1	1	0	0
Average	23.05	36.21	19.94	33.82	24	36.54

F = 3.8 Significant α = .05 and α = .01

Value of the **Word of Mouth** Program

Additional information was collected to determine how the students viewed the **Word of Mouth** program. One concern of the developers was that the computer not interfere with the learning. Students were asked how they felt when working on the computer program. The results indicate that they felt very comfortable (points 1 and 2 on a five point scale); 90% of the TLC experimental group and 85% of the Farnsworth group selected scale points 1 and 2 as reflective of their feelings when working on the **Word of Mouth** Program (see Table 6).

TABLE 6
STUDENTS' OPINIONS OF THE WORD OF MOUTH PROGRAM

1. How did you feel when working on this computer program?

	Very Comfortable 1	2	3	4	5	Very Uncomfortable NR
TLC Experimental	0.58	0.32	0.05	0.05	0	0
Farnsworth	0.31	0.54	0	0.08	0.08	0

A Likert scale was also used to determine students' overall opinions of the Word of Mouth program. The data indicates that 94% of the TLC Experimental group and 85% of the Farnsworth group reported that their attitudes were very favorable (see Table 7).

TABLE 7
STUDENTS' OPINONS OF THE WORD OF MOUTH PROGRAM

2. What is your overall opinion of the Word of Mouth Program?

	Really great 1	2	3	4	5	Really poor NR
TLC Experimental	0.47	0.47	0.05	0	0	0
Farnsworth	0.54	0.31	0.15	0	0	0

A number of open-ended questions were used to help the researchers determine what the students liked or did not like about the **Word of Mouth** program. Students reported that they liked the **Word of Mouth** program because it helped them with their "pronunciation," helped them to "break words down," and helped them learn new words. They also liked being able to hear the words. Selected comments included:

> [It] shows you how to break words down. Helps with pronunciation.
>
> Being able to talk into it. Comparing how I said it with the computer.
>
> You hear the voice and correct your pronunciation. Being able to go over things as many times as you need to.
>
> Shows you how to break up words, pick out vowels & consonants.
>
> [It] helped me learn how to sound out words, especially words with more than one part.

A complete listing of students' comments can be found in Appendix A. Students did not have many criticisms of the program; 59% of the students involved in the study could not identify what they did not like about the program. The students who had a dislike generally reported that it related to using "the mouse," the headphones being "uncomfortable," or pressing the right buttons.

Students specifically identified the ways the **Word of Mouth** program helped them. These responses tend to substantiate the value of the program even though the testing effects may have minimized the degree to which this assertion could be validated statistically. Students reported that the program helped them to break words down, divide the syllables, learn the meanings of words, and to pronounce words.

The results of this study are encouraging to the future of computerized speech in adult reading instruction. They indicate that further research should be done on specific strategies as well as on models that give learners control over several strategies. Future studies should be designed to minimize the effects of testing. The responses of learners to the courseware demonstrated that the project had, indeed, provided a missing link in reading instruction for adults.

The Development Process

At some time in their use of technology, educators are inevitably frustrated with the current state of affairs and would like a chance to do better. The opportunity to develop courseware from scratch is one that challenges an educator to pay extremely close attention to audience, to articulate purpose, to scrutinize the research, and to deliver meaningful instruction. In short, the process is a fine one for sharpening and applying many previously learned skills in instruction.

The experience of developing **Word of Mouth** was a wonderful opportunity for everyone involved with the project. We all agreed that including learners at every stage of the development process is critical. The Technology for Literacy Center frequently reviews or beta tests commercial software that was developed with no learner input. Considering the tremendous cost of producing sophisticated courseware, it always amazes us that the end users play so little role in development. It

was our experience at TLC that learners played an invaluable role in providing feedback to the design team. They reviewed word lists, pilot tested first drafts of the courseware, and verbalized their needs in the area of word attack skills. Their answers to open-ended questions at the end of the research study gave us important information on the strengths and weaknesses of the courseware.

The involvement of learners in courseware development does not preclude the need for expertise in product design and distribution. Apple Computer made a significant contribution to the project by donating three Macintosh computers to TLC. An ideal development model would have included collaboration with a business that could have supplied us with additional technical and financial support. The result of our work is a prototype. However, with the assistance of a computer software company, that prototype could become a comprehensive curriculum. Furthermore, a business would have the marketing mechanisms in place to distribute the courseware.

We are currently in no position to develop and mass market the product. However, we are exploring several options for the future of **Word of Mouth** and hope to find ways that we can continue our work with the model

Dissemination of Results

Dissemination of the results of the project is ongoing. Thusfar, we have written two articles and submitted them for publication. The first, "The Use of Computerized Speech in Reading Instruction for Adults", was submitted to the Journal of Research on Education for Adult Learners (see Appendix G for a copy of the article). The second article, "Using the MacRecorder for Language Practice", was submitted to the Adult Literacy and Technology Newsletter (see Appendix H).

We have submitted one copy of the courseware with this final report to Richard DiCola of the U.S. Department of Education. Further dissemination of the courseware depends on decisions regarding copyright procedures. The courseware will be demonstrated and displayed at this summer's Adult Literacy and Technology Conference. We hope to generate interest in the further development of **Word of Mouth**.

Future Directions

Learner responses to the courseware have convinced us that we must press this project forward. The voice playback function opens a lot of possibilities in several curricular areas. The templates we have already developed for word practice can easily be the basis for reinforcement of word recognition skills in the Laubach series. ESL learners who viewed the software commented that the voice playback and on-line dictionary would be extremely helpful in learning new English words.

We see the potential for using portions of this courseware as adjuncts to specific content areas, e.g., employment-related vocabulary or GED vocabulary. In addition to new applications, some of the original templates have strong designs that could be expanded into complete instructional sequences in specific word attack skills. This project presents us with many possibilities and we are eager to pursue them.

APPENDIX A

Qualitative Data

(TLC EXPERIMENTAL GROUP)

Question 3: What did you like about the program?

* It gives you a selection of words, root words, sentences.
* It was easy.
* Show you how to break words down. Helps with pronunciation.
* The sounding of it, being able to hear and sound out words.
* Showed me how to chop up words better.
* I liked the pronunciation. Can study spelling, reading, and pronunciation at same time. MacRecorder.
* I like learning new things.
* Shows you how to break up words, pick out vowels & consonants.
* You can hear what you are saying. It's different - a good idea.
* Learned how to pronounce your words much better.
* That made me learn words.
* Repeating the words I couldn't pronounce.
* It shows me how to divide and pronounce words, you to say the words right.
* Dividing the words into syllables.
* It showed me how to divide up the syllables. If I didn't know a word I could push a button and it would be said. I could also say it.
* I learned more about how to divide words.
* I like that they had it so you could hear the words. Liked breaking words up into syllables.
* Helps you out with words, when vowels are, dividing them.
* I could do it one-on-one, could go back as many times as needed. Show you how to break up you syllables - training you how to break the words down.

(TLC EXPERIMENTAL GROUP)

Question 4: What didn't you like about the program?

* No (2)
* Nothing (8)
* It was too long.
* The mouse! (2)
* Blank
* Learning how to use arrow
* The buttons - it was hard to get set in the right place.
* Didn't like listening to self in microphone.
* The headphones were uncomfortable.
* Movement of the mouse - pressing the buttons.

Question 5: In what ways did the program help you?

* Helped me learn how to sound out words, especially word with more than one part. It helps in dividing words.
* Showed me how to divide words.
* Help me remember to break words down so I can read them.
* Enjoyed it.
* Handling big words.
* Don't have to bother other people. Divide the syllables, hear the words. Helps in conversation, spelling. She wants more!
* Understanding the meanings of words (dictionary).
* Can sound out words if you know how to break them down.
* I doubt if it helped me at all. It helped me a little with some of the words.
* Helps you spell words, by breaking the words into syllables.
* Able to hear and say the words.
* Taught me how to pronounce words I didn't know.
* It's fun. It helped me a lot to pronounce words. Easier to read when divided.
* Learning syllables, which I didn't know anything about before doing the program.
* The dictionary.
* Divide words better, recall vowels and consonants.
* I thought the program was excellent. I wish they had more of them. I think they use the technology of this program and use it with the most basic words.
* Sounding out words.
* Helped me pronounce a lot of words (vowel sounds).

(FARNSWORTH GROUP)

Question 3: What did you like about the program?

* Learning how to break up words and the dictionary for meanings.
* Seems like it teaches you more. Helped sound out and break up words. Easy to listen to & say unknown words and learn them.
* It's good for my finger.
* The way it teaches pronunciation. That's where I have problems, and breaking up into syllables.
* Being able to talk into it. Comparing how I said it with the computer.
* The computer.
* It helped me in my reading.
* Listening to words and finding them. Challenging self.
* It showed me how to break my word into syllables. Learned about cons. and vowels. Word pronunciation.
* It's satisfying, makes me feel like I'm learning something.
* You hear the voice, and correct your pronunciation. Being able to go over things as many times as you need to. Being able to hear own voice.
* Hearing the words.
* Shows you how to divide and sounds out words. Helped understanding of pronunciation

Question 4: What didn't you like about the program?

* Talking to it and the way it sounds different to hear your voice.
* Moving to lost cursor around.
* No (2)
* Nothing (7)
* The earphones were uncomfortable.
* Not used to headphones.

(FARNSWORTH GROUP)

Question 5: In what ways did the program help you?

* Showing me how to break words apart and pronounce the words.
* Seeing where I was saying words [illegible]. You can work on your own on this.
* Helped with the big words.
* It helped with spelling, review vowels and cons., reading.
* The syllables.
* It helps my reading a lot.
* Breaking the word into syllables.
* Listen to the word and compare pronunciation.
* A lot.
* Working with the computer, sound feedback.
* To be more enthusiastic with my speech and pronunciation.
* Know more new words, speak better.
* Helped me to know how to pronounce a word.

APPENDIX B

Pretest - Learner copy

WORD OF MOUTH PRETEST - Learner Copy

1. recognize
2. wisdom
3. qualification
4. predictably
5. characteristic
6. carpenter
7. illustration
8. important
9. mysterious
10. conviction
11. patience
12. gossip
13. repetition
14. reconsider
15. publicity
16. unpredictable
17. assistant
18. criminal
19. relocation
20. consequences
21. exaggerate
22. victim
23. persuasion
24. enthusiastic
25. occupation
26. random
27. opportunity
28. reputation
29. fantastic
30. intend
31. director
32. curiosity
33. funnel
34. inconsiderate
35. husband
36. dislocate
37. enlist
38. courageous
39. indirectly
40. disqualify
41. custom
42. popularize
43. cactus
44. employable
45. unpopular
46. preoccupation
47. employer
48. pretzel

APPENDIX C

Pretest - Administrator's copy

WORD OF MOUTH PRETEST - Administrator's Copy

Name_____
Site: FarnPALS FarnRdg TLCExp TLCCont
Date_____

Have you ever used a computer before? Yes No
If yes, how comfortable do you feel when using a computer?

1	2	3	4	5	6
Very Comfortable	Comfortable		Uncomfortable	Very Uncomfortable	No Opinion

Directions: Please read aloud the words on the sheet you have, one at a time. If you cannot pronounce a word after trying it, move on to the next word. You are not expected to pronounce all the words so don't worry if you have trouble saying some of them. Please begin.

Words	Pronunciation		
	Correct	Incorrect	Questionable (spell)
1. recognize			
2. wisdom			
3. qualification			
4. predictably			
5. characteristic			
6. carpenter			
7. illustration			
8. important			
9. mysterious			
10. conviction			
11. patience			
12. gossip			
13. repetition			
14. reconsider			
15. publicity			
16. unpredictable			
17. assistant			
18. criminal			

APPENDIX D

Posttest - Learner's copy

WORD OF MOUTH POSTTEST - Learner's copy

1. recognize	I don't recognize you without your glasses.
2. wisdom	The wisdom of that old man is amazing.
3. qualification	I have only one qualification for that job.
4. predictably	The children played in the rain and predictably got muddy.
5. characteristic	What is the one characteristic of a good hunting dog?
6. carpenter	Jill called a carpenter to repair the roof.
7. illustration	Can you give me an illustration of that point?
8. important	Frank had an important meeting to get to.
9. mysterious	That phone call was a little mysterious to me.
10. conviction	The judge gave him a conviction of 20 years in prison.
11. patience	Children just don't have patience for such a long ride.
12. gossip	The people I work with always gossip about each other at lunch.
13. repetition	It just takes a lot of repetition to learn how to do that well.
14. reconsider	Would you please reconsider the idea of going camping in the snow?
15. publicity	The mayor had to quit because of all the bad publicity he got.
16. unpredictable	The weather is unpredictable in June.

34. inconsiderate	That was so inconsiderate to leave me standing at the bus stop.
35. husband	Does your husband like to go hunting?
36. dislocate	Be careful or you might dislocate your shoulder.
37. enlist	Don wants to enlist in the army when he's done with school.
38. courageous	Many people were very courageous when the bridge fell down.
39. indirectly	You can get there indirectly from here.
40. disqualify	That might disqualify you from getting the job.
41. custom	It's our custom to give our grandma a big birthday party.
42. popularize	Most TV ads try to popularize the idea of using their goods.
43. cactus	We bought a cactus at the garden show.
44. employable	With all the skills you have, you are very employable.
45. unpopular	The landlord became a very unpopular fellow when he raised the rent.
46. preoccupation	My son's preoccupation with fire worries me.
47. employer	Your employer should fill out this form and send it to us.
48. pretzel	I had a pretzel and a coke at the movie.

APPENDIX E

Posttest - Administrator's copy

WORD OF MOUTH POSTTEST

Administrator's Copy

ame_____ Site FarnPALS FarnRdg TLCExp TLCCont

		PRONUNCIATION			STRATEGIES USED						
		Correct	Incorrect		Already knew	Sentence (Context)	Word Parts	Spelling Patterns	Word Parts Spell Patt	Unknown
1. recognize	I don't recognize you without your glasses									
2. wisdom	The wisdom of that old man is amazing									
3. qualification	I have only one qualification for that job									
4. predictably	The children played in the rain and predictably got muddy									
5. characteristic	What is the one characteristic of a good hunting dog?									
6. carpenter	Jill called a carpenter to repair the roof									
7. illustration	Can you give me an illustration of that point?									
8. important	Frank had an important meeting to get to									
9. mysterious	That phone call was a little mysterious to me									
10. conviction	The judge gave him a conviction of 20 years in prison									
11. patience	Children just don't have patience for such a long ride									
12. gossip	The people I work with always gossip about each other at lunch									
13. repetition	It just takes a lot of repetition to learn how to do that well									
14. reconsider	Would you please reconsider the idea of going camping in the snow?									
15. publicity	The mayor had to quit because of all the bad publicity he got									
16. unpredictable	The weather is unpredictable in June									

			PRONUNCIATION			STRATEGIES USED						
			Correct	Incorrect		Already knew	Sentence (Context)	Word Parts	Spelling Patterns	Word Parts Spell Patt	Unknown
17.	assistant	The dental assistant cleaned my teeth									
18.	criminal	We knew there was a criminal living in the neighborhood									
19.	relocation	The city gave us money for relocation because our house was torn down									
20.	consequences	Do you know what the consequences are if you get caught?									
21.	exaggerate	Uncle Mike likes to exaggerate his war stories a lot									
22.	victim	He was the third victim on our block									
23.	persuasion	Maybe you could use a little persuation to get a raise									
24.	enthusiastic	The crowd was enthusiastic about the game									
25.	occupation	What is your occupation?									
26.	random	The winners were chosen at random from the group									
27.	opportunity	That's an opportunity you shouldn't pass up									
28.	reputation	Do you think his reputation will still be good after the story is printed?									
29.	fantastic	That was a fantastic movie!									
30.	intend	How do you intend to pay for all this?									
31.	director	She is the director of our choir at church									
32.	curiosity	That kid's curiosity is always getting him into trouble									
33.	funnel	Maybe you could pour that oil easier with a funnel									

			PRONUNCIATION			STRATEGIES USED							
			Correct	Incorrect		Already knew	Sentence (Context)	Word Parts	Spelling Patterns	Word Parts Spell Patt	Unknown		
34.	inconsiderate	That was so inconsiderate to leave me standing at the bus stop											
35.	husband	Does your husband like to go hunting?											
36.	dislocate	Be careful or you might dislocate your shoulder											
37.	enlist	Don wants to enlist in the army when he's done with school											
38.	courageous	Many people were courageous when the bridge fell down											
39.	indirectly	You can get there indirectly from here											
40.	disqualify	That might disqualify you from getting the job											
41.	custom	It's our custom to give our grandma a big birthday party											
42.	popularize	Most TV ads try to popularize the idea of using their goods											
43.	cactus	We bought a cactus at the garden show											
44.	employable	With all the skills you have, you are very employable											
45.	unpopular	The landlord became a very unpopular fellow when he raised the rent											
46.	preoccupation	My son's preoccupation with fire worries me											
47.	employer	Your employer should fill out this form and send it to us											
48.	pretzel	I had a pretzel and a coke at the movie											

1. How did you feel when working on this computer program?

1	2	3	4	5	6
Very Comfortable	Comfortable		Uncomfortable	Very Uncomfortable	No Opinion

2. What is your overall opinion of the Word of Mouth program?

1	2	3	4	5
Really Great				Really Poor

3. What did you like about the program?

Why?

4. What didn't you like about the program?

Why?

5. In what ways did the program help you?

APPENDIX F

Criteria for judging tests

Criterion Measure: Pretest
10/30/'89

General Directions (to be read to the learner):

On your page is a list of words. I would like you to read the words out loud to me, one at a time. If you cannot pronounce a word after trying to say it out loud, move on and try saying the next word.

You are not expected to be able to pronounce all the words, so don't worry if you have trouble saying some of the words.

Please begin whenever you are ready.

Criteria for Judging the Correctness of Pronunciation:

1. Words which are correctly spoken will be noted accordingly.

2. Words which are incorrectly spoken will be noted accordingly.

3. Words which are incorrectly accented and which do not demonstrate pronunciation of a recognizable word will be noted as mispronunciations.

4. Words which are incorrectly accented and which demonstrate correct pronunciation of a word other than the one printed will be noted as mispronunciations.

5. Words which are correctly pronounced, except for the endings, will be further considered prior to any judgement being noted on the checklist.

a. If the word is correctly pronounced with one to two letters missing on the ending due to apparent dialect influences, the word will be noted as correctly pronounced.

b. If the base word is correctly pronounced but the ending is clearly mispronounced, the word will be considered mispronounced.

6. If there is a question about a word, a check mark will go under the "?" column of the checklist and the examiner will fill in the phonetic spelling on the line provided.

After the test is administered, the examiner and a second judge will go over the phonetic spellings to determine whether the words were,in fact, pronounced correctly or not. The impact of dialect differences among speakers will be considered before the final judgement is made. In the case of an impasse between the two judges, a third judge may be called in to evaluate pronunciation of the word(s)in question.

APPENDIX G

Article submitted to
Journal of Research in Education for Adult Learners

THE USE OF COMPUTERIZED SPEECH IN READING INSTRUCTION FOR ADULTS

Claudia T. Bredemus
St. Paul Technology for Literacy Center
March 20, 1990

Abstract

Adults reading below an eighth grade level often request help with word attack skills. Audio input and output is an important element of instruction in word attack, but skill books and most computerized instruction in word attack do not have an audio component. The use of computerized speech to teach adults word attack skills was the object of a study at the St. Paul Technology for Literacy Center. Fifty adult learners at two different literacy sites participated in this study. Two experimental groups of learners used the courseware developed for the study. On post-test measures, all learners showed significant gains and reported great enthusiasm for the courseware.

Unlike children, adults who are learning to read have an extensive experiential background upon which to draw when encountering new words in text. Comprehension is limited, however, when word recognition skills are poor (Perfetti, 1984). For example, many adult learners may not recognize an important and common word such as "information" in text, even though the word is a part of their speaking vocabulary. In studies of literacy acquisition, Thomas Sticht (1978) defines decoding as the process in which "one becomes able to comprehend the written language as well as one can the spoken language".

Adults in literacy programs have often recognized the discrepancy between their oral and reading vocabularies. In a summative evaluation of the St. Paul Technology for Literacy Center (TLC), learners cited the need for instruction in "pronunciation" as one way to improve their reading ability (Patton & Stockdill, 1987). Their perception of this need is consistent with the notion that decoding words is an important avenue to "lexical access" (Perfetti, 1984).

At the same time, these learners expressed great enthusiasm for computer-assisted instruction, which is typically devoid of audio input and output capabilities. The dearth of courseware that incorporates word attack skills and quality audio was the catalyst for a 15-month research and development project at TLC. It was funded by a grant from the U.S. Department of Education, National Adult Education Discretionary Program.

The goal of the project, dubbed "Word of Mouth", was to develop three prototype audio-enhanced instructional modules to teach word attack skills to adults and to study the effectiveness of this courseware. The theoretical assumptions that formed the basis of the project were:

1. Good readers use multiple strategies to figure out unknown words in text.
2. The ability of adults to break down multi-syllabic words is often important to accessing meaning.
3. Quality audio (human and non-human) is a necessary element of instruction in word attack.
4. Adult learners should be introduced to several word attack strategies and given choices in their application.
5. Adults like the privacy, flexibility, and attractiveness of learning on computers.

Proceeding from these assumptions, the project team identified three primary word attack strategies. They are: using the context (including the use of semantic and syntactic cues), word parts, and spelling patterns or syllabication skills. In light of the debate on how reading should be taught, we designed prototypes of each approach and let learners determine which strategies worked best for them.

Our research on learning disabilities (Cox & Hutcheson, 1988) and Durkin's model (1981) led us to include a module on syllabication. The use of context was included not only because it has the strongest support in the literature, but also because many adult disabled readers think reading is a decoding process (Thistlethwaite, 1983). We wanted to legitimize the use of context to learners who felt it was a second-rate way of figuring out unknown words.

Throughout all three modules, the audio component was designed to give learners practice hearing and saying the words presented. To accomplish this, we chose a Macintosh computer with a MacRecorder. This configuration allowed us to deliver quality speech and to design an audio playback template in which learners could say a word, hear their own pronunciation played back, and compare it to a pre-recorded pronunciation.

The study

Fifty adults, reading between a third and sixth grade level, participated in the study. They were all learners from two sites that are part of the St. Paul Public Schools Adult Literacy and Special Needs program. Eighteen subjects were assigned to a control group. The rest were part of one of two experimental groups that used the "Word of Mouth" courseware.

Information on learner characteristics was collected and compared, including demographic data, prior experiences with computers, achievement data, and educational history. An analysis of the subjects determined that the groups did not differ significantly ($\alpha = .01$) with regard to all variables studied.

Criterion-referenced pre- and post-tests on the words taught in the "Word of Mouth" courseware were developed for the study and administered to all subjects. Subjects in the control group took the post-test one week after the pre-test. Subjects in the experimental groups used the courseware and were post-tested one week after the pre-test.

Parametric a priori contrasts were used to compare the experimental and control subjects' prior knowledge of the words taught in the "Word of Mouth" program. The result of this procedure was the assurance that the experimental and control groups had similar knowledge prior to receiving instruction.

Parametric a priori contrasts were used to compare the experimental subjects' pre- and post-test scores. The result was that there was a significant difference ($\alpha = .01$) between the pre- and post-test scores for the learners who received treatment. One disappointment in this study was that the control group also showed a significant difference in scores on the pre- and post-tests, suggesting that part of the observed differences for the experimental groups may be explained by testing effects. However, the qualitative data gave the researchers faith that not all the results could be explained by the testing variable. In open-ended questions, students could specifically identify skills they learned as a result of using the "Word of Mouth" program.

"[It] shows you how to break words down."

"It showed me how to divide up the syllables."

Additionally, learners cited the strength of the audio feature.

"You hear the voice and correct your pronunciation."

"It's easy to listen to and say unknown words and learn them."

Some learners suggested that the program would help their spelling. Many learners requested more lessons in the same format.

Conclusion

The results of this study were encouraging to the future of computerized speech in adult reading instruction. They indicate that further research should be done on specific strategies as well as models that give learners control over several strategies. Future studies should be designed to minimize the effects of testing. The responses of learners to the courseware demonstrated that the project had, indeed, provided a missing link in reading instruction for adults.

REFERENCES

Cox, A. R., & Hutcheson, L. (1988). Syllable division: prerequisite to dyslexics' literacy. Annals of Dyslexia, 38, 226-242.

Durkin, D. (1981). Strategies for identifying words (2nd ed.). Boston: Allyn and Bacon.

Patton, M. Q., & Stockdill, S. H. (1987). Summative external evaluation of the Technology for Literacy Project. In T. C. Turner & S. H. Stockdill (Eds.), The Technology for Literacy Project Evaluation (p. 68). St. Paul: St. Paul Foundation.

Perfetti, C.A. (1984). Reading acquisition and beyond: decoding includes cognition. American Journal of Education, 1:, 40-60.

Sticht, T. G. (1978). The acquisition of literacy by children and adults. In F. B. Murray & J. J. Pikulski (Eds.), The acquisition of reading (p. 140). Baltimore: University Park Press.

Thistlethwaite, L. (1983). The adult disabled reader - An independent learner? Lifelong Learning, 7, 3, 16-17, 28.

APPENDIX H

Article submitted to
Adult Literacy and Technology Newsletter

VOICE PLAYBACK: USING THE COMPUTER AS A "SOUNDING" BOARD

Claudia Bredemus
St. Paul Technology for Literacy Center

How many times have your students told you that the only thing wrong with the computer is that it doesn't pronounce "big words" for them? A recurring frustration of learners at the Technology for Literacy Center has been trying to learn new words and word attack skills via silent computers. While some new network systems feature audio assistance with pronunciation, the majority of educational software, even that designed to teach word attack skills, has no sound.

The **Word of Mouth** project at TLC was born out of this void. Our goal for the project was to develop a model for three different word attack strategies: using the context, word parts, and spelling patterns or syllabication. Central to each approach was the use of a speech device in which learners could pronounce words orally, hear a playback of their voice, and hear a pre-recorded pronunciation of the words.

The combination of Hypercard, the Macintosh computer, and the MacRecorder was a perfect environment for experimenting with the use of quality sound in word attack instruction. The technology itself was relatively low-cost compared to CD-ROM or other configurations that would give us quality sound. Furthermore, as we developed the model, we began to see all kinds of applications for the simple process of presenting words to learners (in or out of specific contexts) and giving them opportunities to use the audio component as they saw fit. Sometimes they could hear words played to them, sometimes they could hear word parts, always they could practice saying the words they were studying.

Fifty adults were involved in a research study using the courseware. Almost all of them liked the options and oral practice **Word of Mouth** gave them. When asked what they liked about the program, they answered:

"Being able to talk into it. Comparing how I said it with the computer."

"You hear your voice and correct your pronunciation."

"It taught me how to pronounce words I didn't know."

"It shows you how to break words down."

Some learners even said the practice with word parts would help their spelling. ESL learners were particularly intrigued with the chance to practice pronunciation. Many opted to practice words several times before moving on.

Word of Mouth presents a prototype of what could be an extensive curriculum in word attack and word recognition skills. Its value is in the discovery of how easily the MacRecorder can be used to develop audio-enhanced instruction that gives learners practice with connecting their reading vocabularies to their oral vocabularies.

For more information, contact Claudia Bredemus at the Technology for Literacy Center, 580 University Avenue, St. Paul, MN 55103